SCHOOL MATHEMATICS KNOWLEDGE TEST

Multiple Choice Questionnaire

The SCHOOL MATHEMATICS KNOWLEDGE TEST is an assessment instrument developed by a team led by the Centre for Advanced Research in Education (CIAE) at the *Universidad de Chile*, within the framework of the project "Diagnosis of Initial Beliefs and Knowledge about School Mathematics, its Learning and Teaching among Students of Primary Teacher Education" (FONIDE FX11624). The results of this research were reported in Martínez et al. (2019), with a description of the levels of mathematical knowledge of the students who participated in the study, their belief systems, and the relationship between both constructs.

Subsequently, within the framework of the project "International Validation of Instruments for the Characterization of the School Mathematical Knowledge of Future Teachers of Mathematics in Basic Education" (INTERDISCIPLINA II180001) led by a team from the *Pontificia Universidad Católica de Chile* (PUC) and carried out in conjunction with the team from the Autonomous University of Barcelona (UAB) that led the project "Study of the Requirements for Admission to Primary Education Teacher Degrees from the Perspective of Mathematical Knowledge" (EDU2017-82427-R), we developed a shortened version of the SCHOOL MATHEMATICS KNOWLEDGE TEST (referred to in this article as the "multiple choice questionnaire") in the study by Rojas et al. (2022). In this questionnaire we adopt the concept of Fundamental Mathematical Knowledge (FMK) developed by the team at the UAB (Castro et al. 2014; Gorgorió et al. 2021) and consider the instrument developed to measure FMK (Gorgorió et al. 2017; Gorgorió and Albarracín, 2020) – which we refer to in Rojas et al. (2022) as an "open questionnaire" and include in this same repository.

Taking data from two samples, one at the UAB and the other at the PUC, we psychometrically validated both questionnaires and analysed whether the thematic grouping theoretically established when defining Fundamental Mathematical Knowledge corresponds to the structure of mathematical knowledge exhibited by student teachers at the beginning of their teacher education.

Castro, Á., Mengual, E., Prat, M., Albarracín, L., y Gorgorió, N. (2014). Conocimiento matemático fundamental para el grado de Educación Primaria: inicio de una línea de investigación. En M. T. González, M. Codes, D. Arnau y T. Ortega (Eds.), *Investigación en Educación Matemática XVIII* (pp. 227-236). SEIEM.

Gorgorió, N., y Albarracín, L. (2020). El conocimiento matemático previo a la formación inicial de los maestros: necesidad y concreción de una prueba para su evaluación. En E. Badillo, N. Climent, C. Fernández & M. González-Astudillo (Eds.), *RED8-Educación Matemática y Formación de Profesores, (pp. 111-132).* Ediciones Universidad de Salamanca.

Gorgorió, N., Albarracín, L., Laine, A., & Llinares, S. (2021). Primary education degree programs in Alicante, Barcelona and Helsinki: Could the differences in the mathematical knowledge of incoming students be explained by the access criteria? *LUMAT*, 9(1) 174–207.

Gorgorió, N., Albarracín, L., & Villareal, A. (2017). Examen de competència logicomatemàtica en la nova prova d'accés als graus de mestre. *Noubiaix, 39*, 58-64.
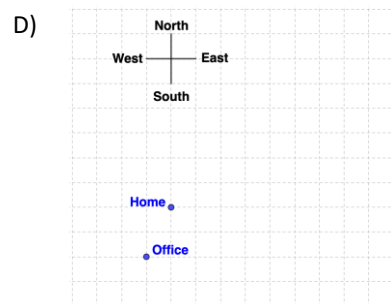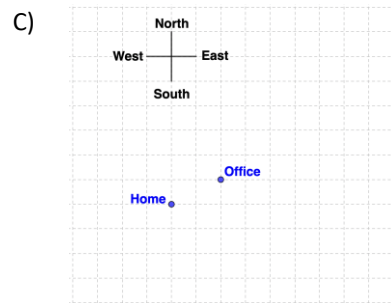
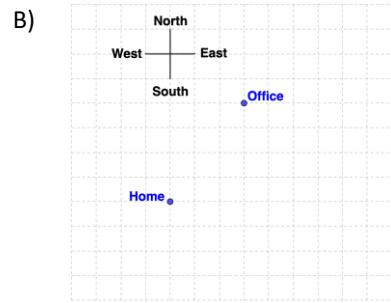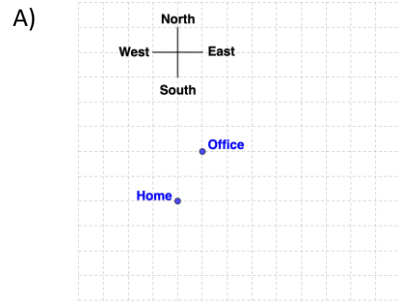Martínez, M. V., Rojas, F., Ulloa, R., Chandía. E., Ortíz, A. y Perdomo-Díaz, J. (2019). Beliefs and Mathematical School Knowledge at the Beginning of Pre-service Primary Teacher Education. *Pensamiento Educativo*, *56*(2), 1-19.

Rojas, F., Albarracín, L., Chandía, E., Ubilla, F.M., Gorgorió, N. (enviado). Explorando instrumentos para evaluar el conocimiento matemático inicial en la formación de maestros de primaria.

C1. The figure shows an object made up of small cubes. Which of the following flat representations corresponds to the top view, if the arrow indicates a side view of the object?

A)

B)

C)

D)
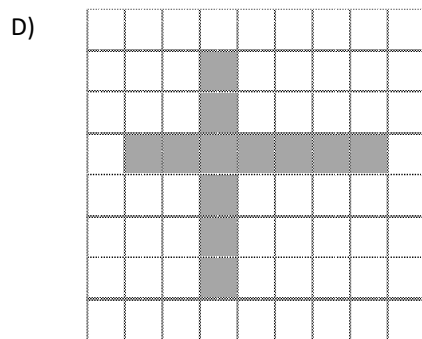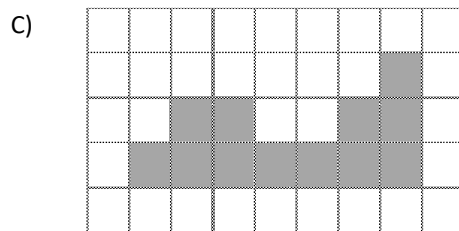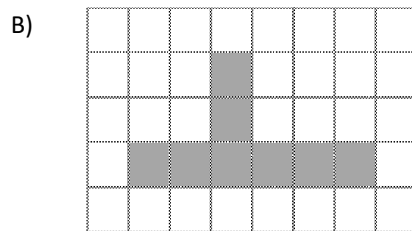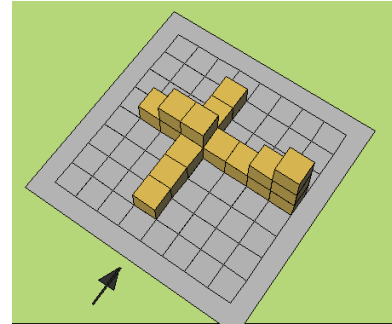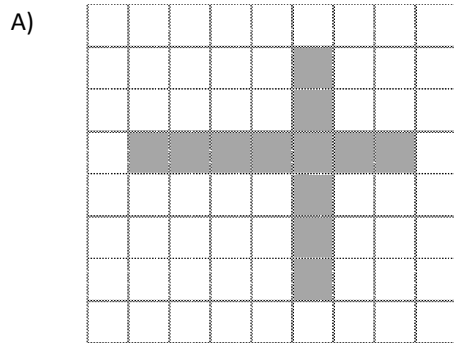
C2. The grid lines represent the streets of a city. Pedro always takes the same route from his home to his office: he walks 2 blocks east, 3 blocks north, 1 block west, and 1 block south. In which of the following images is Pedro's office correctly situated?

A)

North

West ─┼─ East

South

Office

Home

B)

North

West ─┼─ East

South

Office

Home

C)

North

West ─┼─ East

South

Office

Home

D)

North

West ─┼─ East

South

Home

Office

C3. Which of the following images does NOT represent the net of a right prism with a rectangular base?

A)
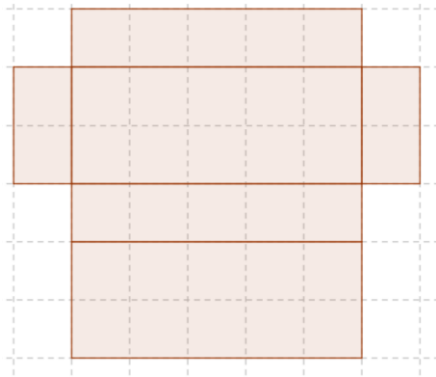
B)

C)

D)

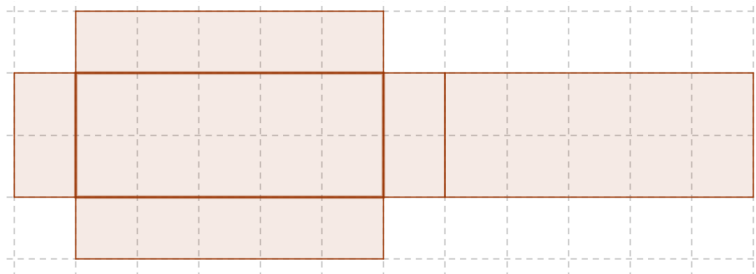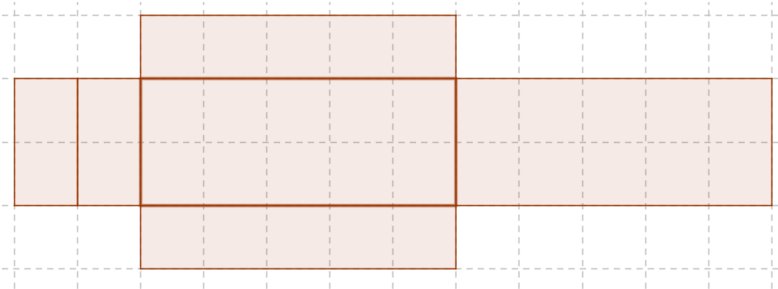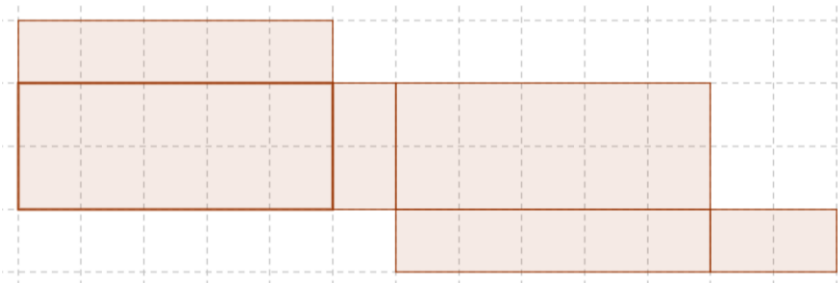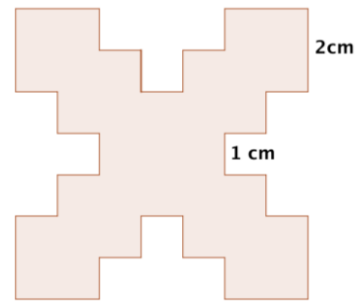**C4.** A quadrilateral has the following vertices given: (2;6), (3;4), (5;4), (6;6). What type of figure is generated?

A) Rhombus

B) Trapezium

C) Square

D) Rectangle

C5. In the following figure, the segments are only 1 or 2 centimetres long. Also, the segments only intersect at right angles. How long is the perimeter of the figure?

A) 28 cm

B) 33 cm

C) 36 cm

D) 44 cm

2cm

1 cm

C6. A teacher asks his students to look at the following table showing the number of children per family in a community.

Nº of Children	0	1	2	3	4	5
Nº of Families	20	30	20	15	10	5

The teacher asks them to describe a procedure for calculating the average number of children per family. Which of the following answers given by the students is correct?

A) I add up the number of families, which is 100, and then I divide by 5 and obtain the average number of children, which is 25.

B) I add up the number of children, which is 0+1+2+3+4+5, obtaining 15, and then I divide this number by 5, obtaining an average of 3 children per family.

C) I add up the number of families, which is 100, and then I divide this number by the total number of children, 15, and I obtain an average of 6.6 children.

D) I multiply the number of families by the respective number of children, add the totals together, and then divide by 100, and obtain an average of 1.8 children per family.

C7. Table 1 shows people's preference by socioeconomic level in a Chilean city with regard to the ideal number of children.

Socio-economic level	Ideal number of children				
	0	1	2	3	4

Low	1.100	600	400	300	100
Medium	4,500	2,100	800	400	200
High	3,600	2,400	1,500	500	200

Table 1: Ideal number of children by socioeconomic level

According to the information in Table 1, which of the following statements is true?

A) The percentage of people among those with a medium socioeconomic level who prefer to have three children is 33%.

B) The percentage of people among those with a medium socioeconomic level who prefer to have three children is 5%.

C) The percentage of people with a low socioeconomic level among those who prefer to have four children is 4%.

D) The percentage of people among those with a low socioeconomic level who prefer to have four children is 25%.

C8. Table 2 shows the distribution of the number of siblings among Andrea's 25 classmates. Which of the following statements is true?

Nº siblings	Absolute frequency	Accumulated absolute frequency	Percentage relative frequency
1	5	5	20 %
2	8	C	E
3	A	D	16 %
4	B	25	F

Table 2: Table of frequencies

A) F = 100%

B) B = 8

C) C = 10

D) E = 52%

C9. In a box, A, there are 2 white balls and 1 black ball; in another box, B, there are 2 white balls, 3 grey balls and 1 black ball. If in a box, C, there are 3 times as many balls as in box A with the same proportion of colours, which of the following statements is WRONG?

A) The probability of taking a white ball from box A and box C is the same.

B) The probability of taking a white ball from box B is 1/6.

C) The probability of taking a black ball from box C is 1/3.

D) The probability of taking a white ball from box B is 2/3.

C10. What is the value of $90 - 20 \cdot (12 - 8) + 200 : 20$?

A) 20

B) 24

C) 290

D) 390

C11. Which of the following sums is correct?

A) $30,000 + 2,000 + 50 + 700 + 2 = 32,572$

B) $11,000 + 200 + 105 + 30 = 11,335$

C) $60,000 + 5,000 + 30 + 1 = 6,531$

D) $400 + 132 = 400,132$

C12. How much is 20% of 20% of 25?

A) 10

B) 1

C) 100

D) 5

C13. What is the answer to $3.95 - 1.99 + 5.04$?

A) 7.00

B) 7.08

C) 7.10

D) 6.90

C14. What is the value of $\frac{10}{3} - \frac{3}{2}$?

A) $\frac{7}{1}$

B) $\frac{11}{6}$

C) $\frac{7}{6}$

D) $\frac{29}{6}$

C15. What is the positional value of digit 4 in 74,001?

A) 4

B) 40

C) 400

D) 4,000

C16. What is the answer to $0 : 1 + 2 \times 0 + 1 : 1$?

A) 0

B) 1

C) 2

D) 4

C17. Which of the following procedures serves to calculate $3,002 - 1,998$?

A) $3,000 - 1,900 + 2 + 98$

B) $3,002 - 1,000 + 900 + 90 + 8$

C) $(3,002 + 2) - (1,998 + 2)$

D) $3,002 + 2 - 1,998 + 2$

C18. Which of the following statements is correct?

A) $\frac{1}{2} < \frac{1}{3} < \frac{3}{4} < \frac{4}{3}$

B) $\frac{4}{3} < \frac{3}{4} < \frac{1}{2} < \frac{1}{3}$

C) $\frac{1}{3} < \frac{1}{2} < \frac{3}{4} < \frac{4}{3}$

D) $\frac{1}{3} < \frac{3}{4} < \frac{1}{2} < \frac{4}{3}$

C19. Using 0.75 litre bottles you have to fill a 5.25 litre drum. How many 0.75 litre bottles are required to fill a 5.25 litre drum?

A) 7

B) Nearly 4

C) Between 1 and 2

D) Nearly 1

C20. Natalia bought two spare parts for her car, one costing $191.990 and the other $399.990. What is the closest approximation to the money spent by Natalia?

A) $500.000

B) $592.000

C) $600.000

D) $692.000

C21. A restaurant's lunch set menu lists 5 types of salad, 4 types of main course, and 3 types of dessert. Considering that customers can only choose one type of salad, one main course and one dessert, how many different menu combinations can the restaurant offer?
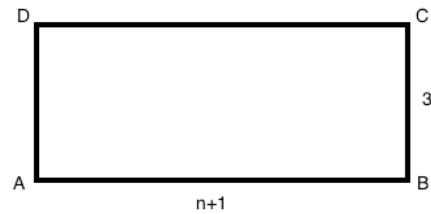
A) 12

B) 27

C) 32

D) 60

C22. How many minutes are there in three and a half days?

    A) 4,320 minutes

    B) 5,040 minutes

    C) 720 minutes

    D) 1,440 minutes

C23. The figure below shows an ABCD rectangle with sides measuring 3 and $n + 1$. What is the total length of the perimeter of ABCD rectangle?
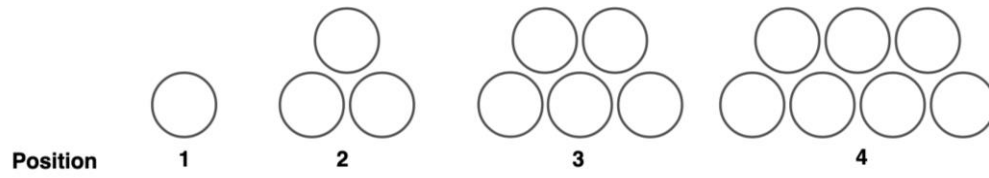
    A) $4 + n$

    B) $7 + 2n$

    C) $7 + n$

    D) $8 + 2n$

C24. The solution to the equation $4 + 2(x - 1) = 2 + 4x$ is:

    A) $x = 0$

    B) $x = 2$

    C) $x = \frac{1}{2}$

    D) $x = \frac{4}{6}$

C25. In the following figure, it can be seen that there are a number of small balls in each position:

Position   1   2   3   4

Which of the following algebraic expressions represents the total number of balls at any n position?

A) $n + (n - 1)$

B) $3n + (n + 1)$

C) $2n + 1$

D) $3n - 2$